

A Variable-Output Bio-Electrochemical System for Wastewater Treatment and Increased Loop Closure in Exploration Life Support Systems, Phase I

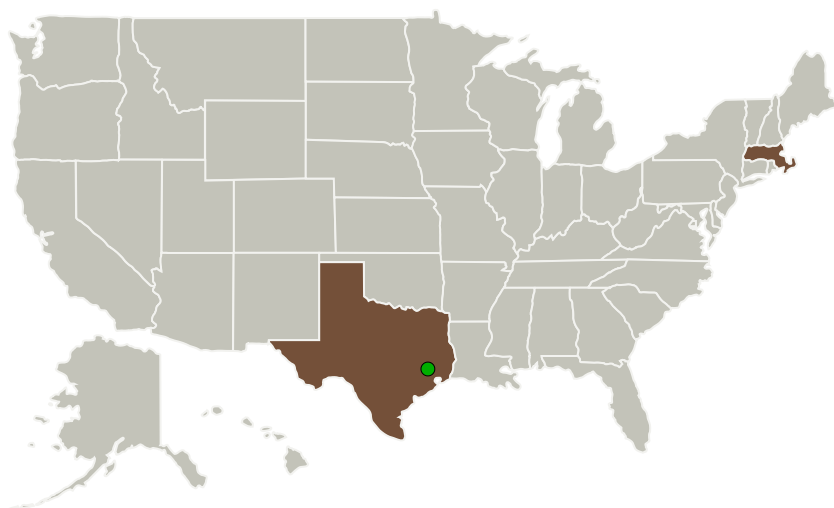
Completed Technology Project (2011 - 2011)



Project Introduction

In this project IntAct Labs proposes to develop a novel system to increase loop closure for water treatment in regenerative life support using bio-electrochemical processes (BEC processes). One of the limiting factors in space exploration, particularly outside of low earth orbit (LEO), involves the power draw and significant mass in oxygen, water and other supplies needed for life support. Bio-electrochemical systems (BECs) are a class of technologies capable of treating water while generating electricity or other value-added products such as methane and hydrogen. In this particular project IntAct Labs proposes a variable-output BEC cell that switch between cathode reactions, generating water, hydrogen, or CO₂ reduction to water and methane, depending on the operation. A properly designed cell might thus switch between cathodic outputs based on day-to-day exploration needs, while continuously treating BOD at a bio-anode at ambient temperature and pressure. During Phase I IntAct Labs will construct a variable output BEC cell, demonstrate simultaneous BOD treatment and value-added product generation with ersatz exploration wastewater streams, and conduct preliminary systems analyses to determine the relative benefit in mass and power associated with operating the system with each output at two unique process points in the ISS Water Recovery System. Based on these experimental and simulation studies, Phase II R&D will focus on one, two, or all three operating modes. Through Phase II and Phase III R&D we hope to develop and test a system for potential utilization aboard the ISS or related crewed systems.

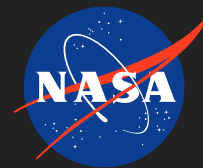
Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Cambrian Innovation, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Boston, Massachusetts
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations

Massachusetts	Texas
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Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137932>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Cambrian Innovation, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

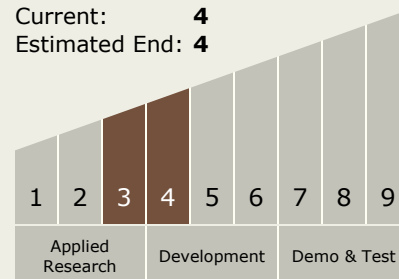
Carlos Torrez

Principal Investigator:

Matthew R Silver

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
 - └ TX06.1.2 Water Recovery and Management

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System